



Space Foundation Teachers

NOAA Satellites & Data Centers

13 June 2013



**Dr. William F. Denig, Chief
Solar-Terrestrial Physics Division
National Geophysical Data Center
NOAA/NESDIS**

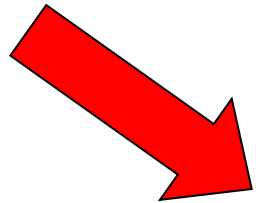
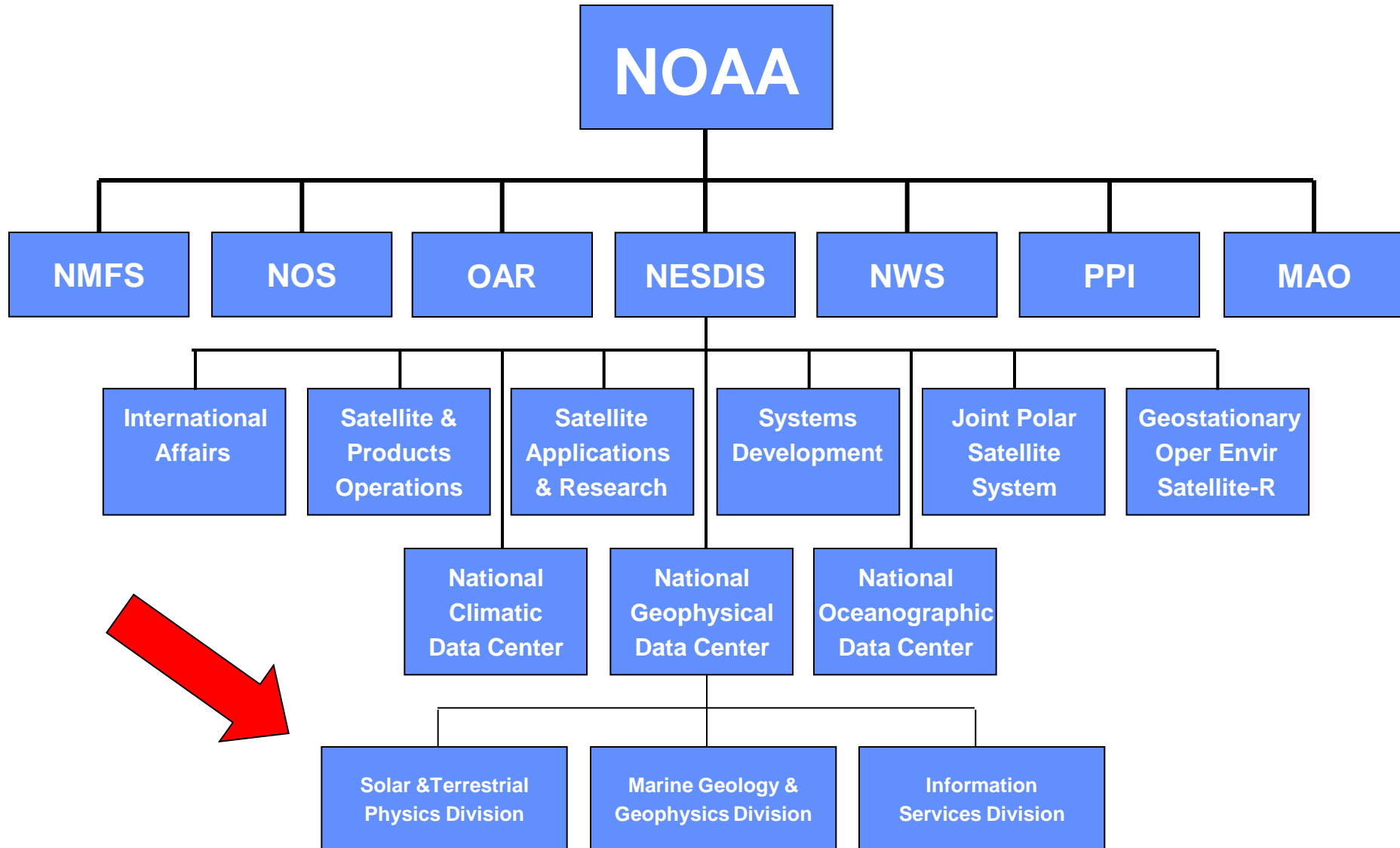
303 497-6323

William.Denig@noaa.gov



NOAA Organizational Chart

National Oceanic & Atmospheric Admin.





Solar & Terrestrial Physics Division

Solar/Space Environmental Assessments

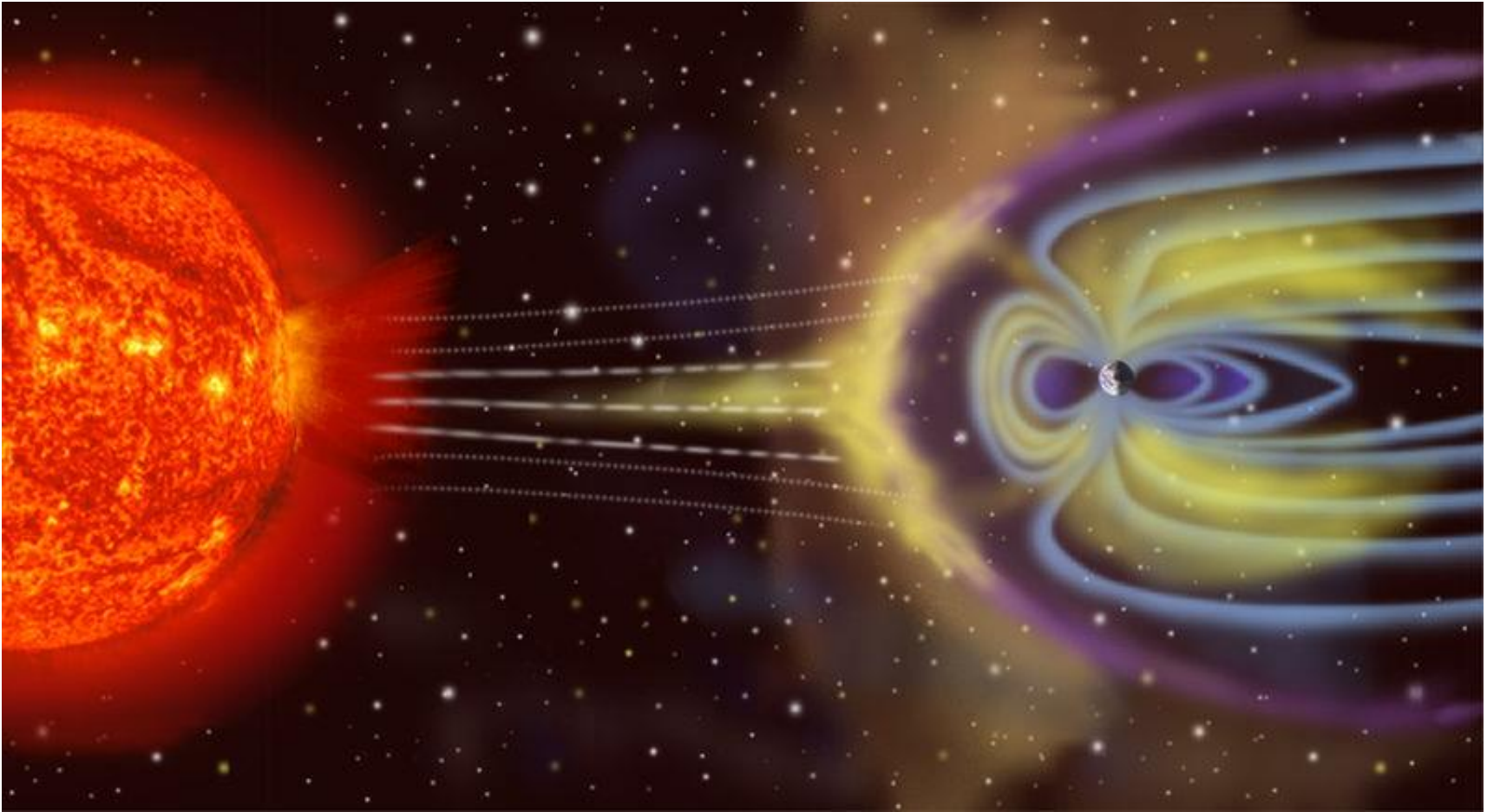


Image not to scale

[Movie](#)



NOAA Space Environmental Data

Satellite Anomaly Assessments



Case 1 – Galaxy-15

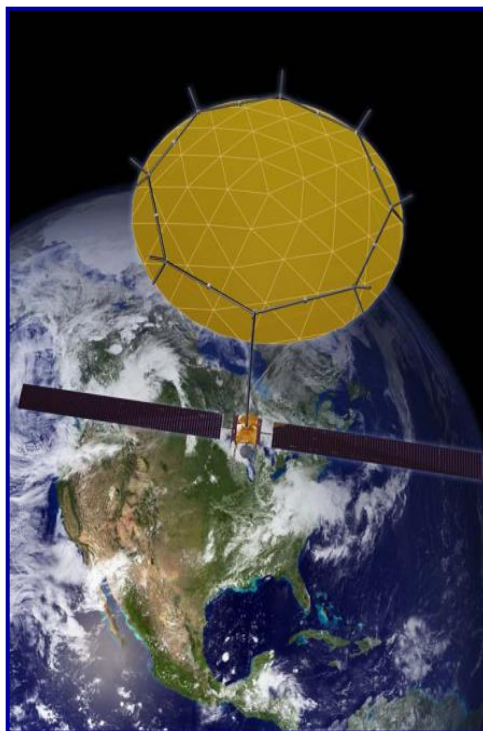
Orbit: Geosynchronous

Anomaly Date:

05 April 2010 @09:48

Probable Cause:

Internal Charging/ESD



Case 2 – SkyTerra-1

Orbit: Geosynchronous

Anomaly Date:

07 March 2012 @14:43

Probable Cause:

Single-Event Upset



Case 3 – NPP/VIIRS

Orbit: Polar LEO

Anomaly Date:


Various

Probable Cause:

Single-Event Upsets

“ZombieSat” – Galaxy 15

A Case Study in Spacecraft Charging




29th Annual International Space Dev
Chicago May 27 - 31 2010
National Space Society

Home Launch Contracts Civil Military **Satellite Telecom** Earth Observation Venture Space Policy

Advertisement

04/08/10 02:33 PM ET

CASBAA Singapore Satellite Industry Forum 2010
14 June 2010
Shangri-La Singapore

Intelsat Loses Contact with Galaxy 15 Satellite
By Warren Ferster
WASHINGTON — Intelsat's five-year-old Galaxy 15 satellite stopped responding to commands early April 5, prompting the company to begin moving an on-orbit spare to the balky satellite's 133 degrees west longitude orbital slot to avoid an interruption in service, Intelsat of Washington and Luxembourg announced April 8.

Galaxy 15 satellite. Credit: Orbital Sciences photo
Intelsat spokeswoman Dianne VanReber

08 Apr 2010 – Intelsat reports that the Galaxy 15 stopped responding to ground commands (Anomaly time: 05 April @ 09:48 UTC)

10 Apr 2010 – FAA predicts erosion of WAAS capability due to Galaxy 15 failure

20 Apr 2010 – Orbital attributes the loss of Galaxy 15 to space weather

30 Apr 2010 – Intel reports Galaxy 15 still adrift and threatens nearby satellites (i.e. frequency interference)



29th Annual International Space Dev
Chicago May 27 - 31 2010
National Space Society

Home Launch Contracts Civil Military **Satellite Telecom** Earth Observation Venture Space Policy

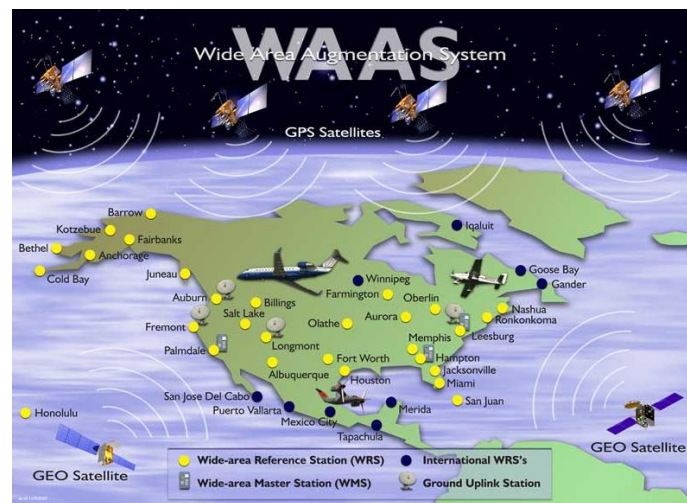
Advertisement

04/20/10 02:05 PM ET

CASBAA Singapore Satellite Industry Forum 2010
14 June 2010
Shangri-La Singapore

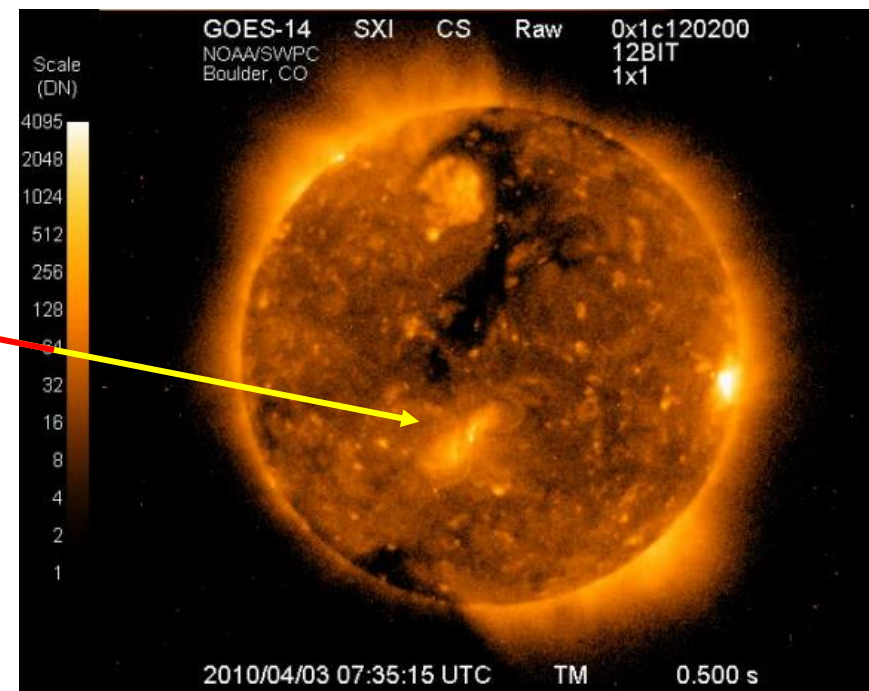
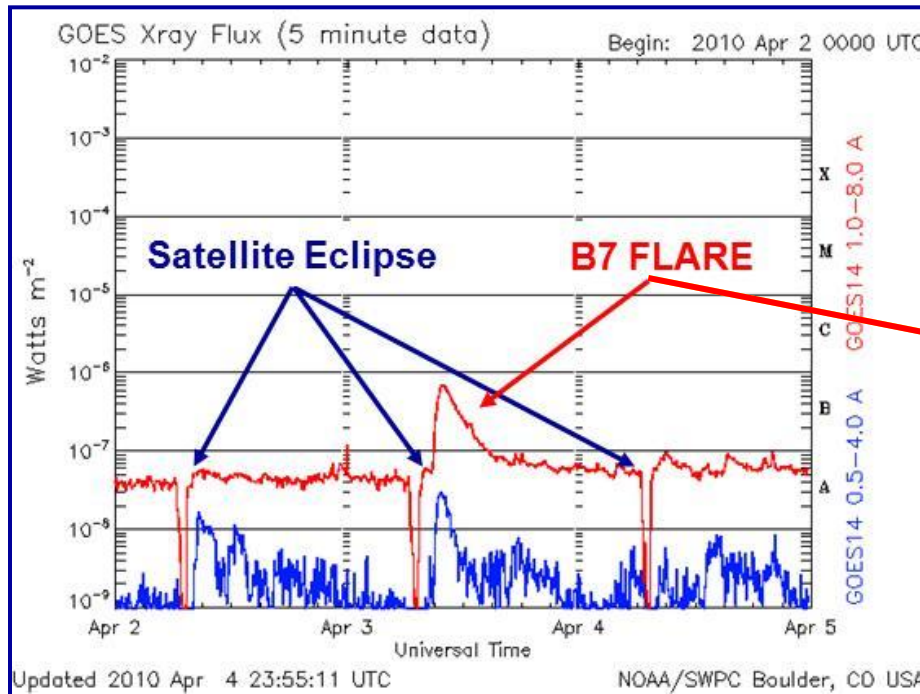
Orbital Blames Galaxy 15 Failure on Solar Storm
By Peter B. de Selding
PARIS — The in-orbit failure of the Orbital Sciences-built Intelsat Galaxy 15 telecommunications satellite April 5 was likely caused by unusually violent solar activity that week that damaged the spacecraft's ability to communicate with ground controllers, Orbital officials said April 20.

Galaxy 15 satellite. Credit: Orbital Sciences photo
Similar events have occurred, if less severely, on other Orbital spacecraft



Transients on the Surface of the Sun

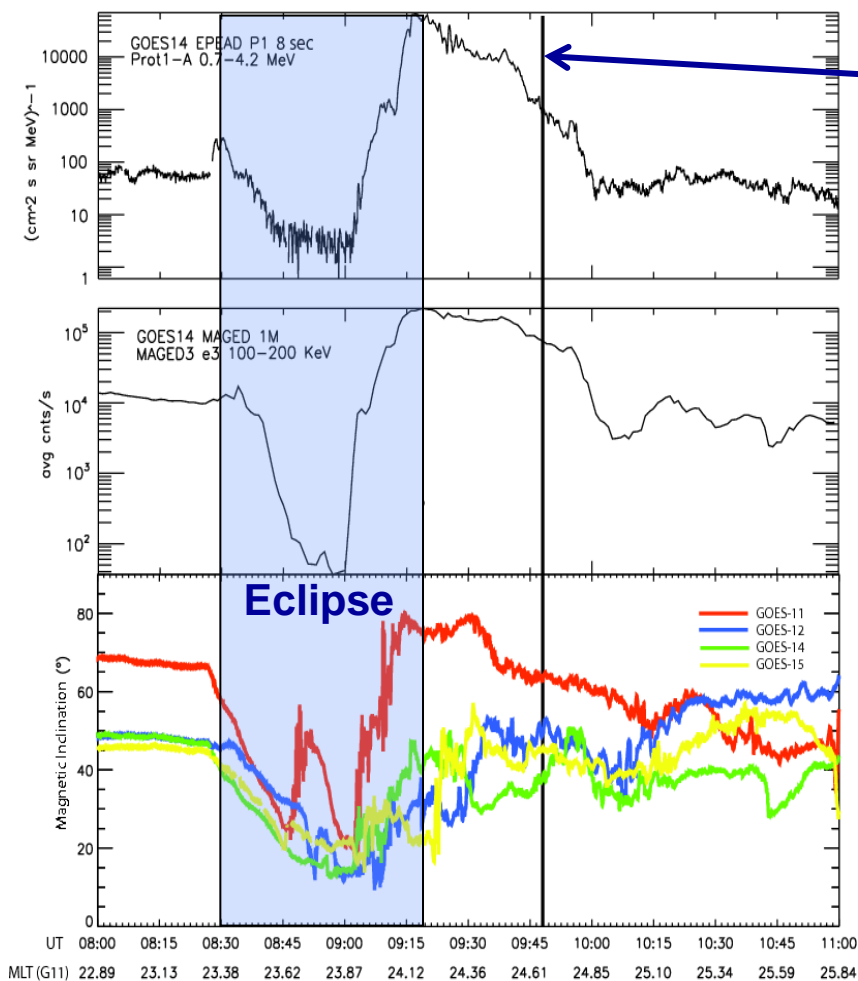
On 03 April 2010 @ 9:54 UT a modest B7 solar flare was observed by the NOAA GOES-14 X-Ray Sensor (XRS) and Solar X-ray Imager (SXI). 2 days later the Galaxy-15 satellite suddenly failed to respond to ground commands.



Local Space Environment

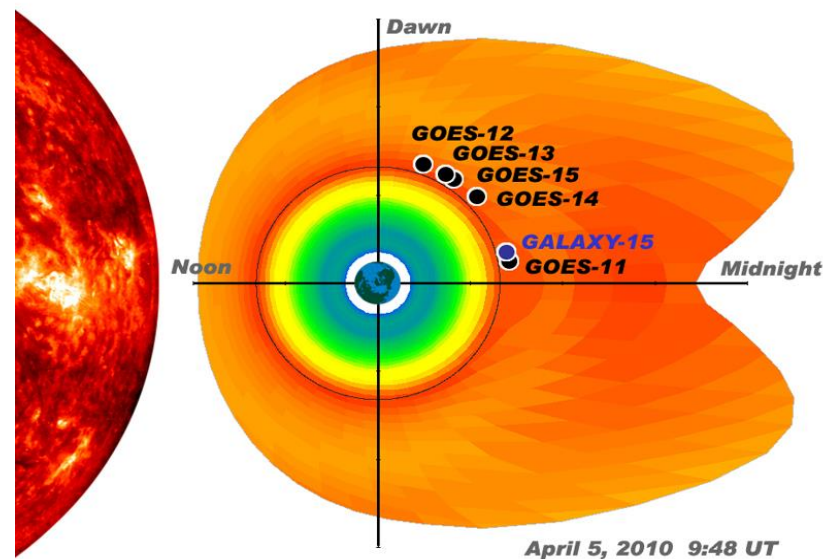
NOAA In-situ Particle & Field Data

April 05 @ 09:00 UT: GOES magnetometers and particle instruments showed a major reconfiguration of the magnetosphere indicative of a substorm and injection of energetic particles into the nightside, geosynchronous orbit location



Galaxy 15 (133 W) Anomaly 09:48 UT

Satellite Locations

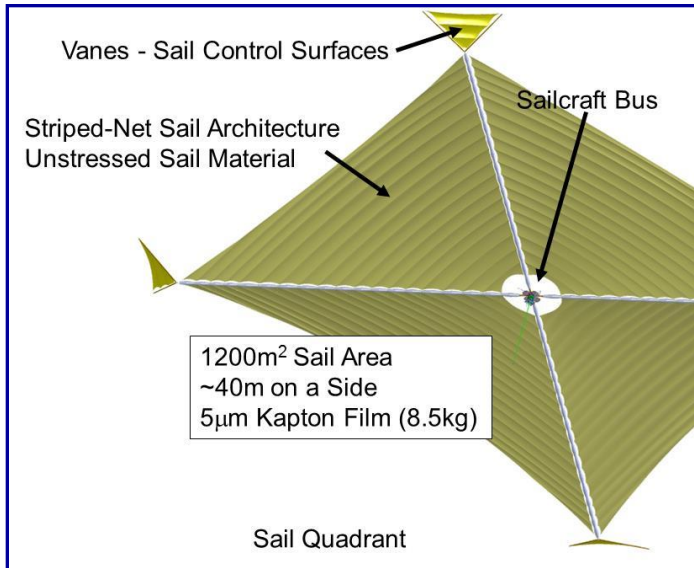


**Space Weather
found to be root cause**

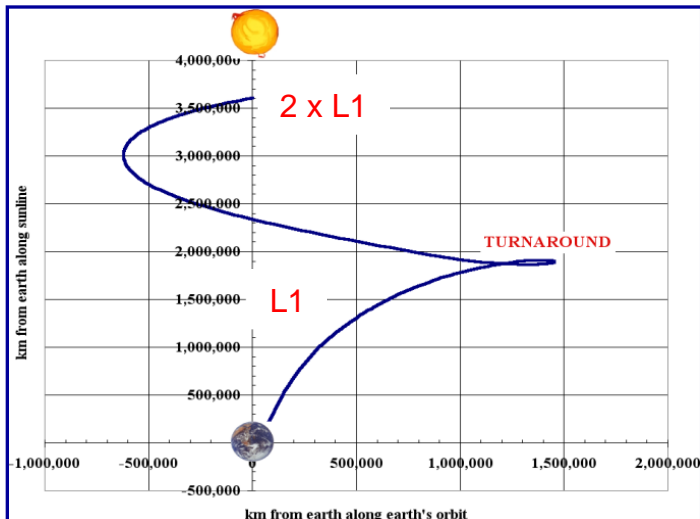


Sunjammer Solar-Sail Demo/FY15

Future Space Weather Monitoring



Solar Sail Deployment



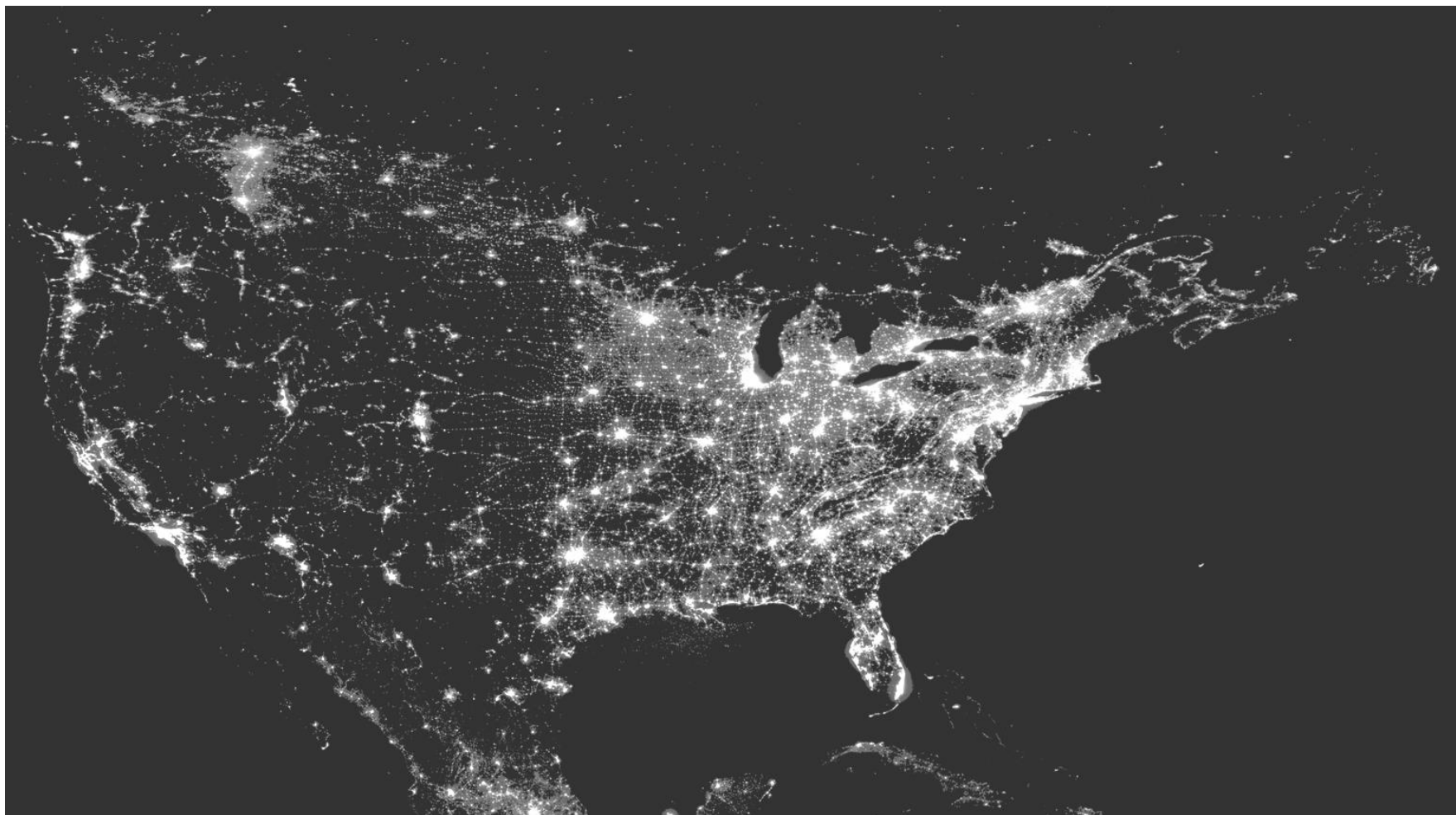


Nighttime Lights of North America

Earth Observations at Night



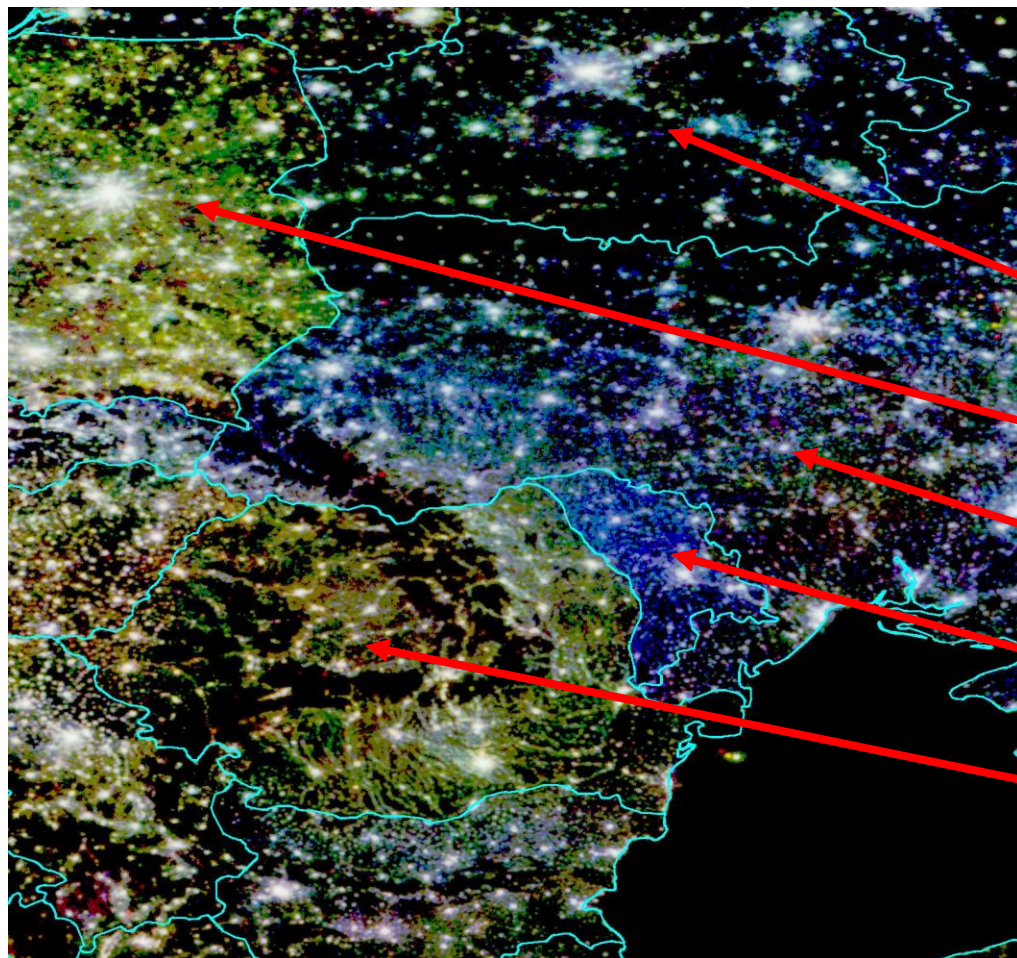
Create yearly cloud-free mosaic



Source: DMSP F15 – 2003 composite

Nighttime Lights of the World

Change Detection in Nighttime Lights



“Stressed”
regions of the
world:

Belarus 

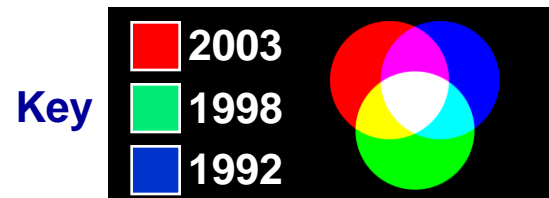
Poland 

Ukraine 

Moldova 

Romania 

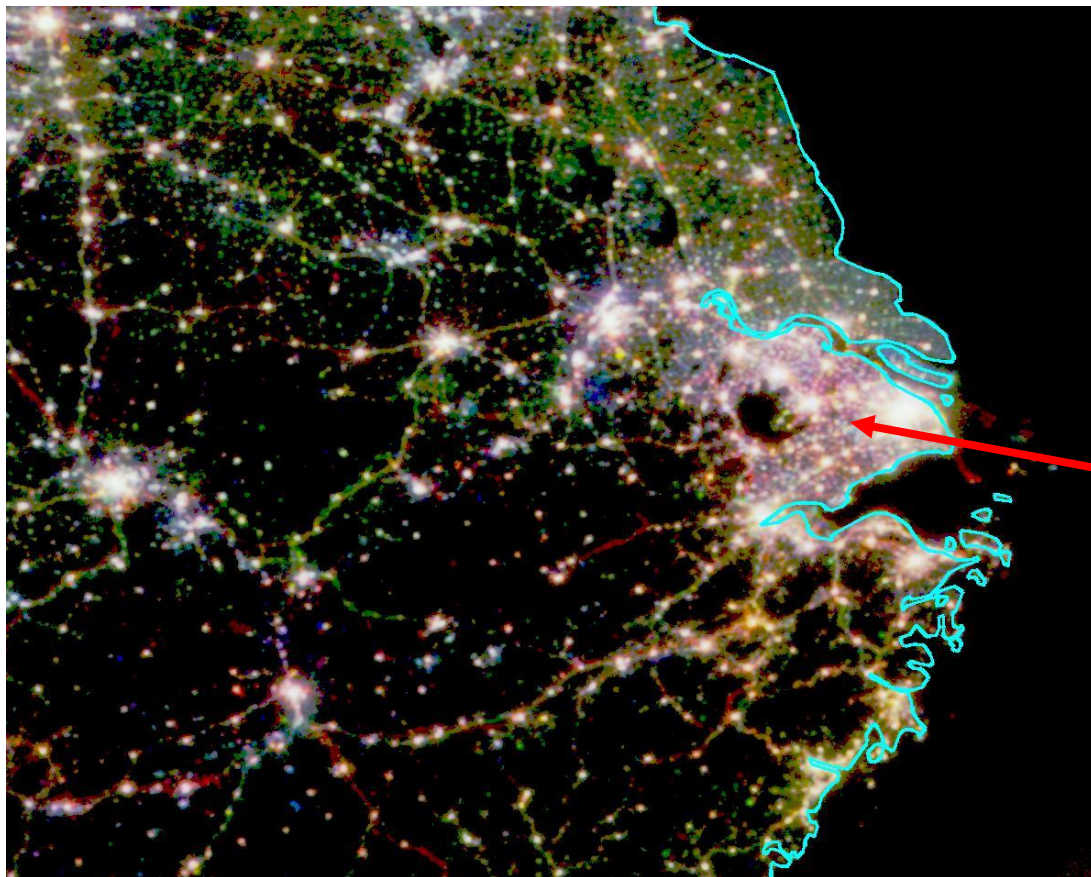
Blue indicates “lights” in 1992 that are
no longer present in 2003





Nighttime Nighttime Lights

Change Detection in Nighttime Lights



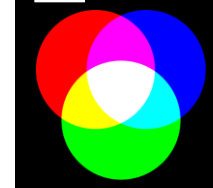
**“Growing”
regions of the
World:**



Shanghai,
China

**Red areas indicate regions of new
“lights” not present before 1998**

Key



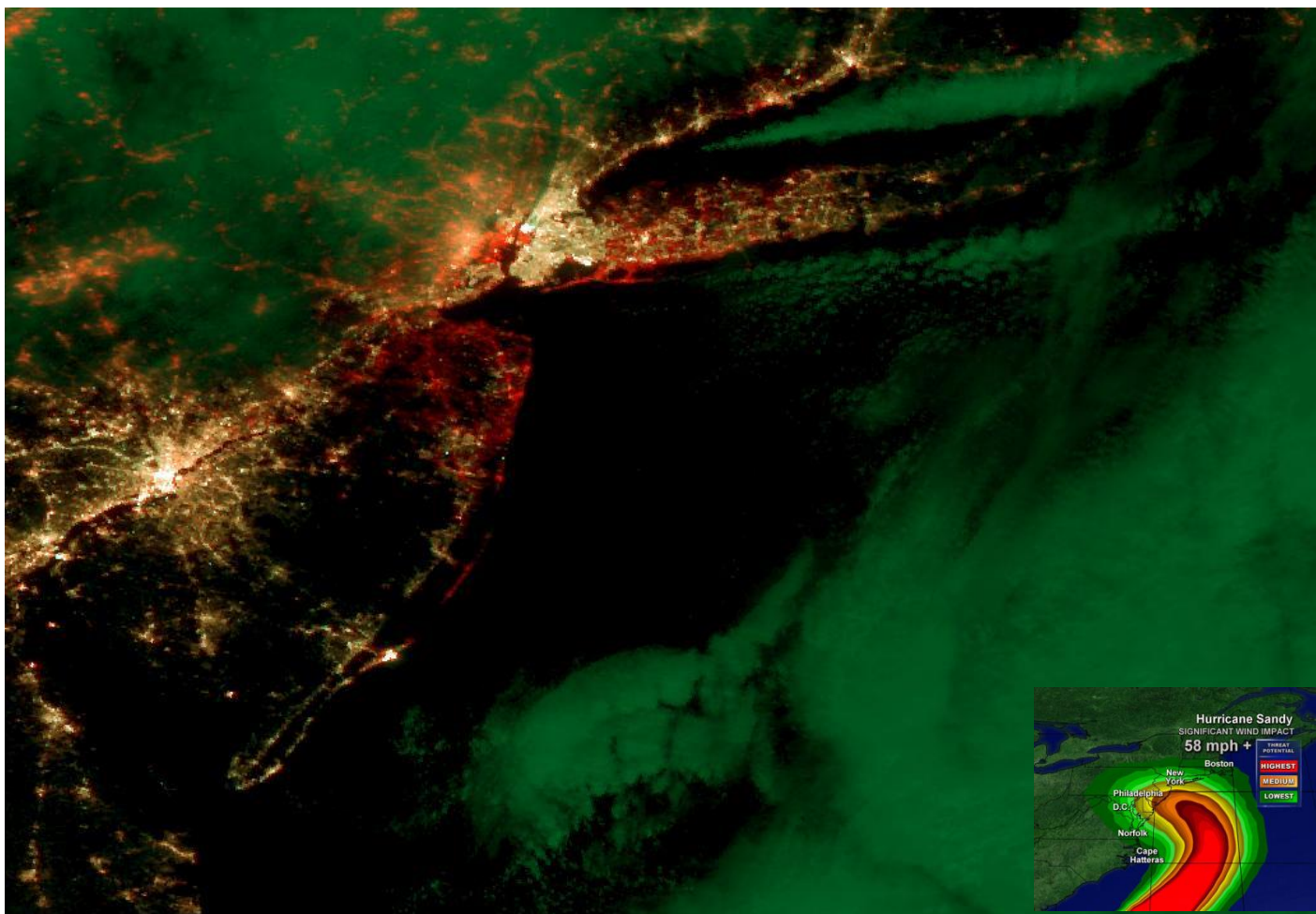


Monitoring Power Outages

Same Technology – Different Application



Hurricane Sandy



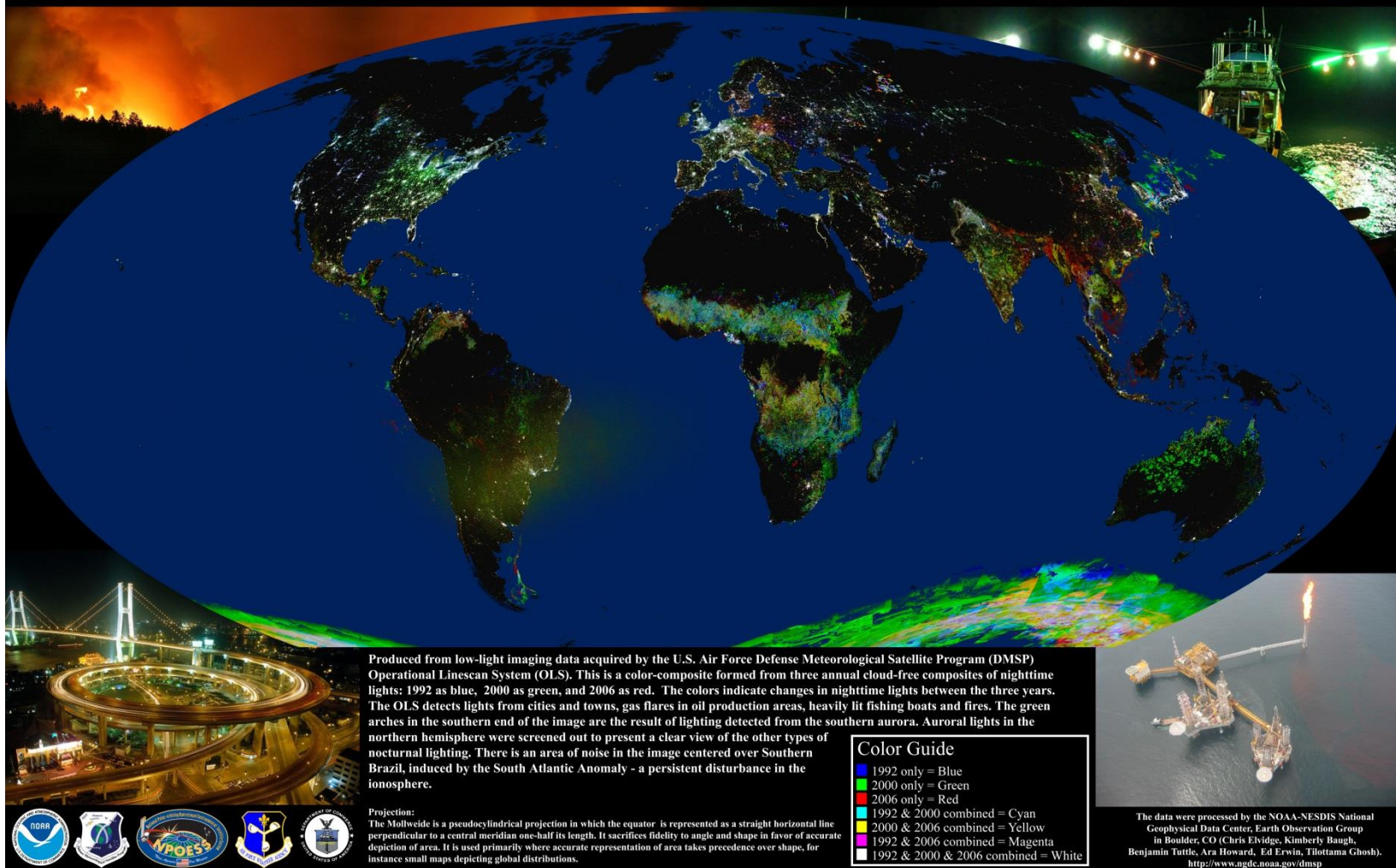


Nighttime Lights Posters

Please Take One



Nighttime Lights of the World: 1992, 2000, 2006



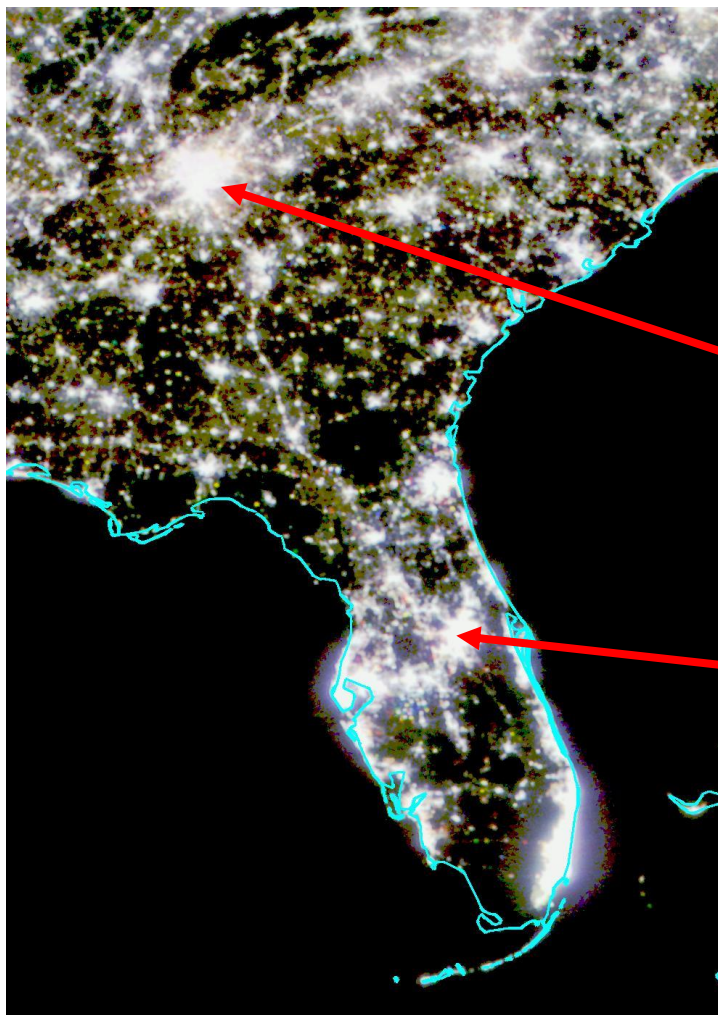


Thank You



Nighttime Lights of the World

Change Detection in Nighttime Lights



**“Stable” regions
of the World:**

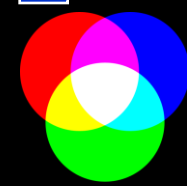


Georgia



Florida

Key



**Predominance of white indicates stable areas with
modest “suburban” sprawl between 1992 and 1998**